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Determining Dominant Physical Factors in Sepak Takraw Service Capabilities

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Abstract

A service technique is an important element in the game of sepak takraw because it is the initial kick made by servers towards the opponent's field as a sign of starting the game. Good service is difficult for opponents to return the ball so that points can be achieved by the server's team. The purpose of this study was to determine the dominant physical factors determining the ability of sepak takraw service. The method used was a correlational study with multiple linear regression analysis. The sampling technique in this study was purposive sampling involving 100 students. This study was carried out from 7th to 13th October 2015 at the Jayapura Sports Building, University of Cenderawasih. The variables of this research were leg length, body weight, core flexibility, leg power, balance and service capability with the formula Y = a + b1X1 + b2X2 + b3X3 + b4X4 + b5X5. In conclusion, the dominant physical factor in the sepak takraw service capability was the leg muscle power variable (X3), because the leg muscle power had the highest standardized coefficient beta value (0.230) compared to other variables.

Keywords: Dominant physical factor; service skill; sepak takraw.

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1. Introduction

Sepak takraw is a combination of soccer and volleyball played on a field of the same size as a double player badminton court, which during a game, the ball must not touch the hand [1]. Sepak takraw is played by two squads, each of which consists of three players, namely server, thrower and striker with one reserve player. Winning in this game is determined by many factors, two of which are individual skills and teamwork. The better the mastery of techniques individually and teamwork, the better the quality of the game. The basic techniques of the game sepak takraw are service, control, smash, heading and block [2]. Feet are the main part of the body to be used in playing sepak takraw. Service or kick is first carried out by server on the ball from the thrower, which must be inside the specified circle when kicking the ball. During service, one of the legs of the server must remain in the circle of service, thus, to be able to do good service requires good physical abilities as well. Physical factors are related to the morphological structure that is closely related to the athlete's body proportion such as height and weight. The anthropometric structure is related to the measure of the athlete's ability to make movements related to the involved sport. Furthermore, Sajoto stated that physical condition is a unified whole of components that cannot be separated, for improvement and maintenance. Prime physicality is an important asset that must be maintained by every athlete consisting of endurance, speed, flexibility, agility, coordination of movement, and strength. Physical abilities are required both in training and in the competition [3]. Sepak takraw is started from a service so that the servers must create a service that is difficult for opponents to control or return the ball. Therefore, servers must aim the ball at the weak opponent's defence to achieve points. This study aims to determine the physical factors that are predominantly essential in sepak takraw servers.

2. Materials and Methods

2.1. Description of the Study Area

The method used in this study is correlational using multiple linear regression analysis with SPSS version 16. This research was carried out on 7th to 13th October 2015 at University of Cenderawasih Sports Building in Abepura Jayapura, Papua..

2.2. Population and Sample

The sampling technique in this study was purposive sampling (Emzir 2008: 41) with 100 samples from a population of 120 students, faculty of sport science, cenderawasih university, Papua were willing to participate in this study.

2.3. Inclusion Criteria

The inclusion criteria were students of sport science, faculty of sport science, cenderawasih university, Papua.

2.4. Exclusion Criteria

The exclusion criteria were:

1. Student who are sick
2. Students who are injured

2.5. Collecting Data and Procedure Intervention

The researcher makes a letter of approval, and the respondent must sign the contents of the report that the respondent is willing to be a sample of this research until the end of the research. Data collection by researcher by measuring ratio of leg length and height, body weight, core flexibility, leg muscle power, balance and ability to service. The formula used was Y = a + b1X1 + b2X2 + b3X3 + b4X4 + b5X5.

2.6. Data Analysis

The collected data is analyzed using the analysis of the Multicollinearity Test to determine whether the independent variables in the regression equation are not correlated with each other, heteroscedasticity test. To determine the occurrence of heteroscedasticity by looking at the presence of certain patterns in scatterplot that shows the relationship between Regression Studentised Residual and Standardized Regression Predicted Value. Test for Normality, Linearity, Multiple Linear Regression Analysis, Regression Coefficient, Determination Coefficient, F Test (Simultaneous Influence), T Test (Partial Influence) All statistical tests performed computerized.

2.7. Ethical consideration and clearance

Ethical approval for this study was obtained from the Ethics Committee, Department of Sport Science, Faculty of Sport Science, Cenderawasih University, Papua, Indonesia.

3. Results

3.1. Leg Length and Height Ratio (X1)

Based on the highest and lowest scores the data range of 8.43 was be obtained. The number of respondents in the study can be used to determine the number of interval classes by using the formula number of classes = 3.3 x log (n) so that a value of 7.6 is obtained.

For the frequency distribution of the ratio of limb length and height the number of rounding classes is used up to 8 classes so that the interval class length can be calculated by dividing the range of data by the number of class intervals and a value of 1.053 is obtained when using the class length interval 2, so that the frequency table of the ratio of the length of the legs and Student body height can be arranged as follows.

Based on Table 1, it describes the data of the ratio of limb length and student body height divided into 8 class intervals. The length of each interval class is 2, the first interval class starts from the lowest height of the respondent that is 58.24 to the highest height of 66.67 with the length of class 2. Fi is the number of frequency class intervals while Xi is the middle value of the interval class.

Table 1: Leg Length Ratio (X1)

Class	Fi	Xi
58,24 – 59,24	23	58,74
59,25 – 60,25	52	59,75
60,26 – 61,26	7	60,76
61,27 – 62,27	15	61,77
62,28 – 63,28	0	62,78
63,29 – 64,29	1	63,79
64,30 – 65,30	1	64,80
65,31 – 66,67	1	65,99

3.2. Weight (X2)

Based on the highest and lowest scores the data range of 39 kg was obtained. The number of respondents in the study is used to determine the number of interval classes by using the formula number of classes = 3.3 x log (n) so that a value of 7.6 is obtained. For weight frequency distribution, the number of rounding classes is above 8 classes so that the length of the interval class can be calculated by dividing the range of data by the number of interval classes and a value of 4.875 is used, the interval class length of 5 is used, then the table of frequency distribution of student body weight can be arranged as follows.

Table 2: Weight (X2)

Class	fi	Xi
45-49	4	47
50-54	21	52
55-59	18	57
60-64	32	62
65-69	20	67
70-74	3	72
75-79	1	77
80-84	1	82

Based on table 2, it is described the student body weight data divided into 8 class intervals. The length of each interval class is 5, the first interval class starts from the lowest height of the respondent that is 45 kg to 49 kg with a class length of 5 kg. Fi is the number of interval class frequencies while Xi is the middle value of the interval class.

3.3. Leg Muscle Power (X3)

Based on the highest and lowest scores the data range of 28 was obtained. The number of respondents in the study is used to determine the number of interval classes by using the formula number of classes = 3.3 x log (n) so that a value of 7.6 is obtained. For the distribution of limb muscle power frequency, the number of rounding classes is above 8 classes so that the length of the interval class can be calculated by dividing the range of data by the number of interval classes and a value of 3.5 is used, the interval class length of 4 is used, then the frequency table of the limb muscle power frequency is used and organized as follows.

Table 3: Leg Muscle Power (X3)

Class	Fi	Xi
54-57	9	55,5
58-61	3	59,5
62 -65	14	63,5
66-69	29	67,5
70-73	20	71,5
74-77	10	75,5
78-81	12	79,5
82-85	3	83,5

Based on table 3, it is described the data on the power of leg muscles of students divided into 8 class intervals. The length of each interval class is 4, the first interval class starts from the lowest leg muscle power that is 54 to 57 with the length of class 4. Fi is the number of interval class frequencies while Xi is the middle value of the interval class.

3.4. Balance (X4)

Based on the highest and lowest scores the data range of 89.8 was obtained. The number of respondents in the study is used to determine the number of interval classes by using the formula number of classes = 3.3 x log (n) so that a value of 7.6 is obtained. For the frequency distribution of balance, the number of rounding classes is used up to 8 classes so that the interval class length can be calculated by dividing the range of data by the number of interval classes and the value of 11.225 is obtained and the interval class length of 12 is used, the student balance frequency distribution table is arranged as follows.

Table 4: Balance (X4)

Class	fi	Xi
8,91-19,91	47	14,41
19,92-30,92	8	25,42
30,93-41,93	7	36,43
41,94-52,94	4	47,44
52,95-63,95	13	58,45
63,96-74,96	8	69,46
74,97-85,97	4	80,47
85,98-98,98	9	92,48

Based on table 4 it is described that the student balance data is divided into 8 class intervals. The length of each interval class is 12, the first interval class starts from the lowest balance of 8.91 to 19.91 with the length of class 12. fi is the number of frequency class intervals while Xi is the middle value of the interval class.

3.5. Core Flexibility (X5)

Based on the highest and lowest scores, a range of data of 23.5 is obtained. The number of respondents in the study is used to determine the number of interval classes by using the formula number of classes = 3.3 x log (n) so that a value of 7.6 is obtained. For the frequency distribution of flexibility, the number of rounding classes is above 8 classes so that the length of the interval class can be calculated by dividing the range of data by the number of interval classes and a value of 2.9375 is used, then the length of the interval class 3 is used, then the flexibility distribution table for students is arranged as follows .

Table 5: Core Flexibility (X5)

Class	Fi	Xi
8-10	7	9
11-13	11	12
14-16	10	15
17-19	25	18
20-22	11	21
23-25	9	24
26-28	20	27
29-31	7	30

Based on table 5, the frequency distribution is described as data on the flexibility of students being divided into 8 class intervals. The length of each interval class is 3 cm, the first interval class starts from the lowest flexibility which is 8 to 10 with the length of class 3. fi is the number of frequency interval classes while Xi is the middle value of the interval class.

3.6. Sepak takraw service ability (Y)

Based on the score of the highest and lowest ability of service will be obtained data range of 22. The number of respondents in the study is used to determine the number of interval classes using the formula number of classes = 3.3 x log (n) so that a value of 7.6 is obtained. For frequency distribution of service capability, the number of rounding classes is used up to 8 classes so that the interval class length is calculated by dividing the range of data by the number of interval classes and a value of 2.75 is used, then the interval class length is taken 3, then the frequency distribution table of sepaktakraw game service capability students is organized as follows.

Table 6: Service Ability (Y)

Class	Fi	Xi
6 - 8	3	7
9 - 11	14	10
12 - 14	19	13
15 - 17	20	16
18 - 20	17	19
21 - 23	11	22
24 - 26	12	25
27 - 29	4	28

The results of table 6 show the ability of student sepaktakraw game services mostly in class intervals between 15-17 of 20 students. Graphically it can be seen that students with service ability who are in the low interval class and high interval class have only a few students while the service ability is in the middle class at the most, this result gives an overview of the student service ability data having a normal distribution.

Prerequisite Test Analysis

Multicollinearity

This test is used to determine whether the independent variables in the regression equation do not correlate with each other. According to Priyatno (2012: 93), a good regression model is free from multicollinearity problems. The consequence of multicollinearity is the correlation coefficient is not certain and the error becomes very large or infinite. Regression is said not to occur multicollinearity when viewed from a tolerance value greater than 0.100 or a VIF value smaller than 10.

Table 7: Multicolinearity Test Results

Variable	Tolerance	VIF	Details
Leg Length (X1)	0.738	1.355	Non Multicolinearity
Weight (X2)	0.824	1.213	Non Multicolinearity
Limb Muscle Power (X3)	0.779	1.284	Non Multicolinearity
Balance (X4)	0.849	1.178	Non Multicolinearity
Flexibility (X5)	0.901	1.110	Non Multicolinearity

Based on table 7, it is known that in all independent variables the tolerance value is greater than 0.100 (0.738 - 0.901) or the VIF value is less than 10 (1.110 - 1.355), so the regression model in this study passes the multicollinearity assumption.

Heteroscedasticity

According to Hindrayani and Totalia (2010), the problem of heteroscedasticity occurs if the error or residual in the model being observed does not have a constant variance from one observation to another. A good regression should not occur heteroscedasticity [4]. To determine the occurrence of heteroscedasticity that is by looking at the presence or absence of certain patterns in scatterplots that show the relationship between regression studentized residuals with regression standardized predicted value [5]. According to Priyatno (2012) establishing the basis for decision making relating to images is [6]:

1. If there are certain patterns, such as the points that form a certain regular pattern (wavy, widened and then narrowed) then heteroscedasticity occurs.
2. If there is no clear pattern, and the points spread above and below the number 0 on the Y axis, then heteroskedasticity does not occur.

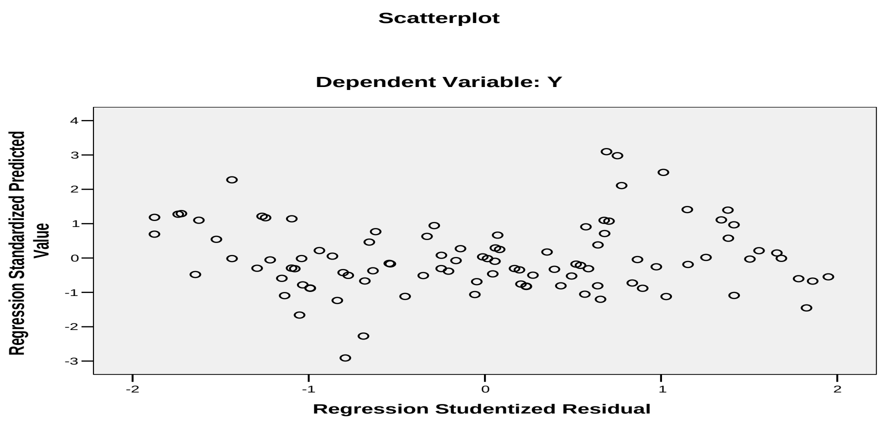

Figure 2: Scatterplot between Regression Studentised Residual and Regression Standardized Predicted Value.

Based on Figure 2 it is known that there is no clear pattern, and the points spread above and below the number 0 on the Y axis, then there is no heteroscedasticity.

Normality

Normality test in this regression analysis is used to test whether in this research regression model there are confounding or residual variables that have a normal distribution. There are two ways to detect whether residuals are normally distributed or not, namely the Kolmogorov – Smirnov statistical test and using the Normal P-Plot [7]. Normality test in this study was obtained by Normal P-Plot as follows. The basis of decision making used according to Santoso and Tjiptono (2001) is as follows [5]:

1. If the data spread around the diagonal line and follows the direction of the diagonal line, then the regression model meets the normality assumption.
2. If the data spreads far from the diagonal line and or does not follow the diagonal line, then the regression does not meet the assumption of normality.

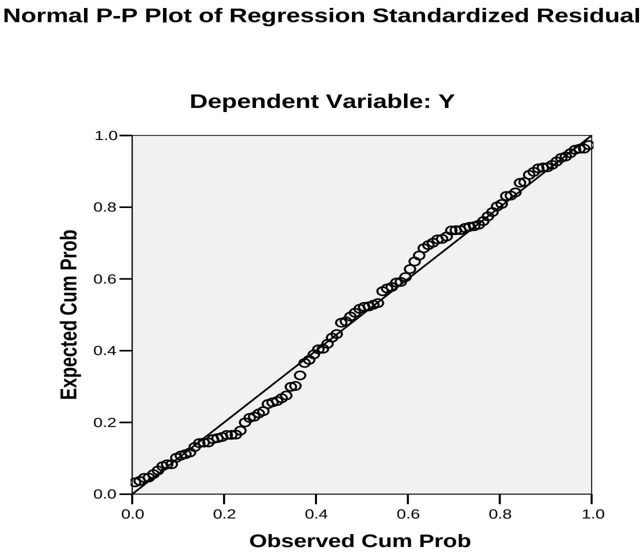

Figure 3: Scatterplot between Regression Studentised Residual and Regression Standardized Predicted Value.

Based on Figure 3 it is known that the data distribution spreads around the diagonal line and follows the direction of the diagonal line, then the regression model meets the normality assumption.

1. Linearity

Linearity test is used to detect a linear relationship between variables X and Y that can be done to determine whether there is a linear relationship between the independent and dependent variables, then using a linearity test. The relationship is said to be linear if the deviation from linearity score p / sig. > 0.05 [8].

Table 8: Linearity Test Result

Deviation from Linierity	F	p	Detail
Leg Length and Height Ratio (X1)	0.966	0.539	Linear
Weight (X2)	0.812	0.719	Linear
Leg Muscle Power (X3)	1.169	0.300	Linear
Balance (X4)	1.295	0.428	Linear
Core Flexiblity (X5)	0.979	0.519	Linear

Based on table 8, it is known that each independent variable studied has a value of p> 0.05 (p = 0.300 - 0.719), which means that the regression model has passed linearity.

Multiple regression linear

This study uses multiple regression analysis techniques with 5 independent variables (X1 = Leg Length and Height Ratio, X2 = Weight, X3 = Leg Muscle Power, X4 = Balance, X5 = Core Flexibility) and one dependent variable Y = Takraw Service. Based on the results of the study obtained the results of multiple linear regression analysis with SPSS version 16 obtained the following results.

Table 9: Multiple Linear Regression Count Results

Model	$\hat{Y}$ = 12.053 - 0,106X1 - 0,105X2 + 0,182X3 + 0,042X4 + 0,168 X5				
F test	5,535				
F sig	0,000				
Adj R2	0,180				
Variable	Regression Coefficient	Beta	t	p	Decision
Constant	12.053				
P.T and T. B ratio (X1)	-0.106	-0.026	-0.243	0.809	H_0 Received
Weight (X2)	-0.105	-0.138	-1.378	0.171	H_0 Received
Leg Muscle Power (X3)	0.182	0.230	2.227	0.028	H_0 Rejected
Balance (X4)	0.042	0.215	2.176	0.032	H_0 Rejected
Core Flexibility (X5)	0.168	0.197	2.055	0.043	H_0 Rejected

Regression Coefficient

Based on the results of the equation of the regression line model is explained as follows.

1. A constant value of 12,053 means that if there are no other variables that affect the value of sepak takraw service is 12,053.
2. The coefficient value of the ratio of limb length and height (X1) - 0.106 means that if the ratio of leg length to height increases 1%, it will reduce the value of sepak takraw service by 0.106%.
3. The coefficient of weight (X2) - 0.105 means that if the weight increases by 1% it will reduce the value of sepak takraw service by 0.105%.
4. The value of the leg muscle power coefficient (X3) is 0.182 meaning that if the leg muscle power value increases by 1% it will increase the value of the sepak takraw service by 0.182%.
5. The coefficient of balance (X4) 0.042 means that if the balance rises by 1% it will increase the value of sepak takraw service by 0.042%.
6. Core flexibility coefficient value (X5) 0.168 means that if the core flexibility value increases by 1%, it will increase the ability of sepak takraw service by 0.168%.

Determinant Coefficient

Adjusted R square value (double determination coefficient) shows the value of 0.180, which means that 18.0% of the variance of the service takraw variable data can be explained by the five independent variables namely X1 = Leg Length and Height Ratio, X2 = Weight, X3 = Power Limb Muscle, X4 = Balance, X5 = Strike Flexibility. And the rest (100% -18% = 82%) is explained by other causes outside the model.

F Test (Simultant Effect)

F test is used to determine whether all independent variables have real influence or not on the dependent variable. Based on table 9 it is known that the significance value for the F test gets a value of p = 0,000 (p <0.05), meaning that H0 is rejected, so there is a significant effect between variables X1 = Leg Length and Height Ratio, X2 = Weight, X3 = Limb Muscle Power, X4 = Balance, X5 = Strike Flexibility of the dependent variable Y = Sepak Takraw Service.

The t-test (Partial Effect)

Based on the results of table 9, it is known that the results of the hypothesis testing of each independent variable on the dependent variable are as follows.

1. The ratio of leg length and height ratio get a value of t = -0.243 with p = 0.809 (p> 0.05) meaning that H0 is accepted, so there is no significant effect between the ratio of leg length and height to the sepak takraw service value.
2. The weight variable gets the value of t = -1.378 with p = 0.171 (p> 0.05) meaning that H0 is accepted, so there is no significant effect between the weight variable in the sepak takraw service value.
3. The leg muscle power variable gets a value of t = 2.227 with p = 0.028 (p <0.05) meaning H0 is rejected, so there is a positive and significant effect between the leg muscle power variable on the sepak takraw service value.
4. The balance variable gets the value of t = 2.176 with p = 0.032 (p <0.05) meaning that H0 is rejected, so there is a positive and significant effect between the balance variable on the sepak takraw service value.
5. The core flexibility variable gets the value of t = 2.055 with p = 0.043 (p <0.05) meaning that H0 is rejected, so there is a positive and significant effect between the core flexibility variable on the sepak takraw service value.

4. Discussion

To be able to have a good ability of sepak takraw service, it is necessary to measure several physical conditions including the length of the legs as the dominant physical condition. This study examined the factors of leg length, body weight and dominant physical determinant of sepak takraw's service ability. The results of this study show that 18.0% of the variance of the variable data service capability takraw can be explained by the ratio of leg length and height, bodyweight, leg muscle power, balance and core flexibility. Where the five variables significantly influence the ability of sepak takraw service simultaneously with a value of p = 0,000. In this study, it is known that 3 variables significantly influence the service level, the leg muscle power variable, p-value = 0.028, the balance variable gets the p-value = 0.032, and the core flexibility variable gets the p-value = 0.043. These three variables have a positive effect on the ability of sepak takraw services. Where the higher the value of leg muscle power, flexibility and balance, the higher the score of service ability. This leg muscle power variable is the dominant variable among 3 significant and positive variables in influencing service takraw scores. This is in line with the theory put forward by Sajoto, (1988) that the freshness of muscle strength is a picture of the ability of muscles or muscle groups to do work by holding the weight they lift [3]. As it is known that leg muscles are the most powerful muscles after the back muscles in supporting limbs activity because power is the maximum effort from a combination of strength and speed in moving explosively. This leg muscle power component is not only needed by the server for service but is also needed by the right wedge and the left wedge when doing a smash. This study in line with Rohman Hidayat et.al who said that there is a significant effect of limb muscle power on sepak takraw skill, icluding service [9]. Research conducted by Herman shows that there is a contribution of leg muscle power on service capabilities in sepak takraw game with a contribution of 44.0% [10]. This study also reinforced by research conducted by Ahmad Jamalong that show there is a significant relationship between leg muscle power and flexibility with the ability to serve in the game sepaktakraw on target sepaktakraw club athletes Tunas Muda District Mempawah West Kalimantan, Indonesia [11]. Likewise, with the balance variable also has a significant and positive effect on the service takraw score where the higher the balance value the higher the service takraw score. As it is known that balance is the ability of a person to control the nerve organs of his muscles during fast movements, with changes in the location of weight points that are fast too, both in a static state more so in dynamic motion. In doing the service, the balance factor is very much needed by a server in maintaining body position during the service process so that in the event and directing the ball can hit the target correctly. This sudy in line with the research conducted by Jufrianis et.al on 40 athletes student education and training center Jakarta who showed that there is a significant influence body balance against accuracy of the first game of sepak takraw athlete [12]. The core flexibility variable is a variable that also has a significant and positive effect on service takraw scores. Where the higher the value of core flexibility, the higher the service takraw score. Good flexibility is generally achieved when all the joints of the body show the ability to move smoothly according to their function. Whether someone's shape is determined by the extent of the limited space for the joints that can be done. Thus the combination of flexibility and strength and balance will be a good flow path (fluidity) for an athlete. The flexibility of the body supports the mastery of sepak takraw. Sepak takraw players can learn sepak takraw techniques with satisfying results if they have a body that is flexible and not rigid. Always warm-up and then stretch the body before playing sepak takraw. This sudy in line with the research conducted by Jufrianis et.al on 40 athletes student education and training center Jakarta who showed that there is a significant influence leg flexibility against accuracy of the first game of sepak takraw athlete [12].

5. Conclusions

After a discussion of the results of the study, the dominant physical factors determining the ability of service in sepak takraw are successive as follows: The leg muscle power variable gets a value of $t = 2.227$ with $p = 0.028$ ($p <0.05$) meaning H0 is rejected, so there is a positive and significant effect between the leg muscle power variable on the service takraw value. The balance variable gets the value of $t = 2.176$ with $p = 0.032$ ($p <0.05$) meaning that H0 is rejected, so there is a positive and significant effect between the balance variable on the service takraw value. The core flexibility variable gets the value of $t = 2.055$ with $p = 0.043$ ($p <0.05$) meaning that H0 is rejected, so there is a positive and significant effect between the core flexibility variable on the service takraw value.

6. Implication

By paying attention to the research results, conclusions, and discussion of the research results, the implications of the results of this study may contain the development of broader multivariate statistics if examined about the dominant implications for the sepak takraw service with multiple linear regression analysis. From the variables that are analyzed using multiple linear regression analysis will produce a dominant variable in the ability of service in the game takraw. Based on the conclusions that have been drawn, the implications can be put forward in efforts to improve the achievement of sepak takraw especially in improving the physical condition of leg muscle power. With the discovery that the physical factor of leg muscle power becomes the most dominant factor in the ability of sepak takraw service, in learning takraw, limb muscle power must be the main concern if we want to get good service results. Although in learning, it is not possible for leg muscle power to stand on its own, but also other physical conditions have a share so that mutual support in one unit becomes a good physical condition. With good leg power and anthropometry, they will be interrelated to produce a performance that is good service capability. Because after all anthropometry is good but does not have leg power then the expected service will not be achieved and vice versa if the athlete has good leg power but the athlete is less proportional because he does not have good anthropometry then the ability of service in sepak takraw will not be maximized. The weakness of this study is that the sample is not an athlete, so it needs to be continued using an athlete sample.

7. Recommendation

a. In choosing an athlete who will be a server in the game of soccer, he should pay attention to the anthropometric components, especially the ratio of leg length and height, weight, leg muscle power, core flexibility, and balance to be indicators.
b. In the development of sepak takraw achievement is expected to train muscle strength, balance, and flexibility core routinely to perform sepak takraw service properly.
c. The coach is expected to provide additional hours for male students to coach the sepak takraw achievement that still has a low score in takraw service ability.
d. Fellow researchers should conduct further research with a broad scope and see the possibility of other variables that also have a positive relationship with the ability of service in sepaktakraw games.

8. Competing interest

The authors declare that they have no competing interest.

9. Recommendations

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